REMARKS

Applicant affirms the election of claims 1-18 without traverse. Claim 4 has been amended to overcome the § 112 rejection at paragraph 7 of the Office Action. Claims 2, 17, and 18 have been amended to correct formalities. Claim 1 has been amended to recite that the sonic energy source is in contact with the workpiece for introducing sonic energy to the workpiece. New claims 29-32 have been added. Claims 1-18 and 29-32 are pending in the application. Reconsideration and withdrawal of the remaining rejections are requested in view of the following amendments and remarks.

The claims are directed to an apparatus for processing a workpiece including a heater for heating a process liquid before the liquid is applied to a workpiece, an ozone gas supply for providing ozone gas around the workpiece, and a sonic energy source for introducing sonic energy to the workpiece. As recited in amended claim 1, the sonic energy source delivers sonic energy to the workpiece surface. As described at e.g. paragraph [0019] of the application, the sonic energy acts on the workpiece.

Turning to the § 102 and § 103 rejections, Satoh, U.S. Patent No. 6,235,112 B1, does not disclose an apparatus where sonic energy source acts on the workpiece, as recited in claim 1. Rather, Satoh discloses an ultrasonic wave vibrator 20 that is used to transform a liquid reaction material 5 into a mist to be sprayed onto a substrate 2 (col. 5, lines 36-43). Satoh describes an atomizer, which has no physical effect on the workpiece. The ultrasonic wave vibrator 20 cannot introduce sonic energy to the substrate 2, as claimed. Rather, the vibrator 20 is spaced apart from the substrate 2 so that mist formed by the ultrasonic wave vibrator 20 can be distributed evenly on the substrate surface (col. 5, lines 40-43; Fig. 2). Satoh uses sonics purely to generate a

mist. In Satoh, ultrasonic energy is not applied to the workpiece. As is well known in the art, ultrasonic energy can only move through solid materials, and through incompressible liquids. Ultrasound cannot move through gases or vapors. Since there is no solid or liquid connection in Satoh between the vibrator 4 and the workpiece 2, it is very clear that no ultrasonic energy is applied to the workpiece. Consequently, Satoh does not suggest the "sonic energy source for introducing sonic energy to the workpiece" as described in claim 1.

In Satoh, the workpiece 2 is heated (to e.g. 400°, col. 6, line 7). This is not a liquid or "wet" process. No liquid is applied to the workpiece. Only vapor is applied. Col. 5, lines 40-42. The vapor is not heated. Only the workpiece is heated. Accordingly, Satoh fails to suggest the "at least one heater for heating the liquid before it is applied onto the workpiece" as included in claim 1.

For these same reasons, Satoh also fails to disclose the ". . . liquid outlets. . . element of claim 1.

While Fig. 3 of Satoh shows a liquid diluent supply 44, no liquid diluent contacts the workpiece. Rather, the liquid diluent is used only to thin out the coating material 5, before the coating material is atomized by the sonic vibrator 6. Col. 6, lines 37-57. See also the T-pipeline connection mixing the diluent and coating material, before they reach the atomizer 6.

Regarding amended claim 2, in Satoh, there is no contact between the atomizer or vibrator 4 and the workpiece.

Regarding claim 4, there are no liquid outlets in Satoh, and no liquid applied to the workpiece.

Regarding claim 5, in Satoh, no sonic energy reaches the workpiece, and clearly there can be no focusing of sonic energy on the workpiece, because there is no material through which the sonic energy can travel to reach the workpiece.

Thus, there is also no suggestion to contact the substrate 2 with the ultrasonic wave vibrator 20, since the spaced apart configuration is required to evenly distribute the mist to the substrate surface.

Turning to the secondary references, applicant does not here contest the content of those references, as set forth in paragraphs 11 and 12 of the Office Action, (although applicant does contest the conclusions therein). Suffice it to say that none of JP5-13398, JP4-125927, EP782177 or Lorimer 5,063,609, suggest the combination of elements described in the claims.

New claim 29 recites that a sonic energy source is located on a swing arm, with the swing arm moveable to deliver sonic energy between a center and an edge of the workpiece (see application, paragraph [0023]). New claim 30 recites that the sonic energy source is associated with the liquid source for delivering sonic energy to the workpiece via the liquid delivered from the liquid source (see application, paragraphs [0021] – [0022]). New claim 31 recites that a sonic energy source is located on the workpiece holder for introducing sonic energy to a workpiece held on the workpiece holder, as recited in allowed claim 16. None of the cited references teach or suggest a sonic energy source located on a swing arm or a workpiece holder. Thus, claims 29-31 are believed to be in condition for allowance.

New claim 32 recites a means for controlling a thickness of a liquid layer on the workpiece surface, and a sonic energy source in contact with the liquid layer for

delivering sonic energy through the liquid layer to the workpiece surface (see application, paragraphs [0018], [0025] and [0026]; Fig. 3). None of the cited references teach or suggest such a feature. Thus, claim 32 is believed to be in condition for allowance.

In view of the foregoing, it is submitted that the claims are in condition for allowance, and a Notice of Allowance is requested.

Respectfully submitted,
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COMPLETE SET OF PENDING CLAIMS

1. (Original) An apparatus for processing a workpiece comprising:

a liquid supply source;

one or more liquid outlets disposed to apply liquid onto the workpiece;

a liquid flow line extending between the liquid supply source and the one or more liquid outlets for carrying liquid to the liquid outlets;

at least one heater for heating the liquid before it is applied onto the workpiece;

an ozone gas supply system which provides ozone gas around the workpiece; and

a sonic energy source for introducing sonic energy to the workpiece.

2. (Currently Amended) The apparatus of claim 1 further comprising a sonic energy conductor ~~in contact with~~ attached to the sonic energy source and in contact with the ~~sonic energy source~~ workpiece.

3. (Original) The apparatus of claim 2 wherein the sonic energy conductor comprises quartz, silicon, metal or a polymer.

4. (Currently Amended) The apparatus of claim 1 ~~with~~ wherein the sonic energy source is associated with the liquid outlets, to provide sonic energy to the workpiece via liquid moving out of the outlets and onto the workpiece.

5. (Original) The apparatus of claim 1 wherein the sonic energy source comprises a sonic transducer including a focusing chamber for concentrating sonic energy onto the workpiece.

6. (Original) The apparatus of claim 1 where the liquid supply source comprises a liquid reservoir, and where the heater heats the liquid in the reservoir.

7. (Original) The apparatus of claim 1 where the liquid supply source includes a liquid selected from the group consisting of, ammonium hydroxide, sulfuric acid, hydrochloric acid, hydrofluoric acid, a surfactant, de-ionized water, and a combination thereof.

8. (Original) The apparatus of claim 1 further comprising a chamber around the workpiece and with the ozone gas supply connected to the chamber to provide ozone gas around the workpiece in the chamber, with the ozone provided as a dry gas or in a liquid.

9. (Original) The apparatus of claim 8 further comprising a re-circulation liquid line extending between the chamber and the liquid supply source.

10. (Original) The apparatus of claim 8 further comprising a rotor assembly in the chamber for rotating the workpiece.

11. (Original) The apparatus of claim 1 where the liquid outlets comprise liquid nozzles for spraying the heated liquid onto the workpiece.

12. (Original) The apparatus of claim 1 further including means for controlling the thickness of a layer of the liquid formed on the surface of the workpiece.

13. (Original) The apparatus of claim 12 where the means for controlling comprises a liquid flow control system for controlling the flow of liquid onto the workpiece.

14. (Original) The apparatus of claim 13 where the liquid flow control system includes spray nozzles.

15. (Original) The apparatus of claim 12 where the means for controlling comprises a rotor for holding and rotating the workpiece.

16. (Original) An apparatus for treating the surface of a workpiece comprising:

a liquid reservoir for holding a process liquid;

a process chamber;

a workpiece holder within the process chamber;

liquid spray nozzles within the process chamber disposed to spray liquid onto the workpiece held by the workpiece holder;

a liquid flow line extending between the liquid reservoir and the liquid spray nozzles;

an ozone generator for generating a supply of ozone;

one or more ozone supply lines extending from the ozone generator to the process chamber;

at least one heater for heating the process liquid; and

a sonic energy source on the workpiece holder for introducing sonic energy to the workpiece.

17. (Currently Amended) The ~~system~~ apparatus of claim 16 where the workpiece support holds the workpiece in a horizontal orientation.

18. (Currently Amended) The ~~system~~ apparatus of claim 16 further comprising a valve connecting to a spent liquid line extending from the process chamber, to the liquid reservoir, and to a drain, with the valve switchable between a first position, wherein spent liquid from the process chamber is directed back to the

reservoir, and a second position, wherein spent liquid from the process chamber is directed to the drain.

19 – 28. (Withdrawn and Cancelled).

29. (New) An apparatus for processing a workpiece comprising:

a process chamber;

a workpiece holder within the process chamber for holding a workpiece;

a liquid source for delivering a liquid to a surface of the workpiece to form a liquid layer on the workpiece surface;

an ozone supply system for delivering ozone into the process chamber; and

a sonic energy source on a swing arm for delivering sonic energy through the liquid layer to the workpiece surface, with the swing arm moveable to deliver the sonic energy ~~between a center and an edge of~~ to the workpiece.

30. (New) The apparatus of claim 29 wherein the sonic energy source is associated with the liquid source for delivering sonic energy to the workpiece via the liquid delivered from the liquid source.

31. (New) An apparatus for cleaning a workpiece, comprising:

a process chamber;

a workpiece holder within the process chamber;

an ozone supply system for delivering ozone into the process chamber; and

a sonic energy source on the workpiece holder for introducing sonic energy to a workpiece held on the workpiece holder; and

a liquid supply source for delivering a liquid on to the workpiece.

32. (New) An apparatus for treating the surface of a workpiece comprising:

a process chamber;

a workpiece holder within the process chamber for holding a workpiece;

a liquid supply source for delivering a liquid to a surface of the workpiece to form a liquid layer on the workpiece surface;

means for controlling a thickness of the liquid layer formed on the workpiece surface;

an ozone supply system for delivering ozone into the process chamber; and

a sonic energy source in mechanical or fluid contact with the liquid layer on the workpiece surface for delivering sonic energy through the liquid layer to the workpiece surface.